What is Claimed is:

1. A method of synchronizing a selected number of time division multiplexed or TDM symbols in a TDM data stream to an equal number of the subcarriers of a time division multiplexed/multicarrier modulated or TDM-MCM symbol in a TDM-MCM waveform comprising the steps of:

locating one of a master frame preamble (MFP) code and a distributed synchronization sequence in said TDM data stream, said TDM data stream having at least one TDM frame comprising said one of a MFP code and a distributed synchronization sequence and a plurality of said symbols, said one of a MFP code and a distributed synchronization sequence being useful to locate said TDM frame within said TDM data stream;

generating an array using said symbols in said TDM frame, said array comprising a first number of columns and a second number of rows; and

generating TDM-MCM symbols corresponding in number to said first number using an Inverse Fast Fourier Transform (IFFT) with said array, each of said TDM-MCM symbols having said second number of said subcarriers for respective ones of said TDM symbols in corresponding said rows, said first number of said TDM-MCM symbols corresponding to a TDM-MCM symbol frame.

2. A method as claimed in claim 1, wherein said generating step comprises the step of filling said array by providing the earliest arriving of TDM symbols in said TDM frame into the earliest generated one of said rows of said array, and continuing to sequentially fill said rows until the last of said rows is filled with the last of said TDM symbols in said TDM frame.

3. A method as claimed in claim 1, wherein said TDM data stream comprises a plurality of TDM frames, said TDM-MCM symbol frame having essentially the same duration as said TDM frame.

4. A method as claimed in claim 1, wherein said generating step comprises the step of synchronizing said TDM-MCM symbols in said TDM-MCM symbol frame to within a fraction of one of said symbols in said TDM data stream.

5. A method as claimed in claim 4, wherein the number of said TDM-MCM symbols in said TDM-MCM symbol frame is an integer number.

6. A method as claimed in claim 1, further comprising the step of providing each said TDM-MCM symbol in said TDM-MCM frame with a guard interval, the TDM-MCM symbol period corresponding to said second number divided by the number of said TDM symbols per second, said guard interval being less than said TDM-MCM symbol period.

7. A method as claimed in claim 1, further comprising the step of providing each said TDM-MCM symbol frame in said TDM-MCM waveform with a synchronization word.

8. A method as claimed in claim 1, further comprising the steps of:

providing each said TDM-MCM symbol in said TDM-MCM frame with a guard interval, the TDM-MCM symbol period corresponding to said second number divided by the number of said TDM symbols per second, said guard interval being less than said TDM-MCM symbol period;

providing each said TDM-MCM symbol frame in said TDM-MCM waveform with a synchronization word; and

compressing each said MCM-TDM symbol to compensate for the insertion of said guard interval and said synchronization word in each said TDM-MCM symbol frame such that said TDM-MCM symbols having said guard interval and a time allocation corresponding to said synchronization word for the corresponding said TDM-MCM frame occupy one TDM frame period.

9. A method as claimed in claim 1, wherein said IFFT employs a number of coefficients that is greater than said second number of said symbols.

10. A method as claimed in claim 1, wherein said TDM data stream comprises a plurality of TDM frames, said generating step further comprising the step of assigning said symbols in respective said TDM frames in said TDM data stream to said subcarriers of said TDM-MCM symbols in corresponding said TDM-MCM frames.

11. An apparatus for use at a terrestrial re-radiation station comprising:

a receiving device for receiving a time division multiplexed or TDM data stream comprising symbols, each of said symbols corresponding to a selected number of bits in said data stream; and

a processing device connected to said receiving device and operable to locate one of a master frame preamble (MFP) code and a distributed synchronization sequence in said TDM data stream, said TDM data stream having at least one TDM frame comprising said one of a MFP code and a distributed synchronization sequence and a plurality of said bits, said one of a MFP code and a distributed synchronization sequence being useful to locate said TDM frame within said TDM data stream;

wherein said processing device transforms said symbols in said TDM data stream into respective subcarriers to generate a time division multiplexed/multicarrier modulated or TDM-MCM waveform comprising TDM-MCM symbols, each of said TDM-MCM symbols having a selected number of subcarriers, said processing device employing said one of a MFP code and a distributed synchronization sequence to synchronize said symbols in said TDM data stream with corresponding ones of said subcarriers in respective said TDM-MCM symbols.

12. An apparatus as claimed in claim 11, wherein said processing device employs an inverse fast Fourier transform (IFFT) to transform said symbols in said TDM data stream into respective said subcarriers.

13. An apparatus as claimed in claim 12, wherein a TDM-MCM frame comprises a selected number of said TDM-MCM symbols, said processing device being operable to generate an integer number of said TDM-MCM symbols for said TDM frame in said TDM data stream.

14. An apparatus as claimed in claim 13, wherein said processing device is operable to provide each said TDM-MCM symbol frame with the same said symbols in a corresponding said TDM frame.

15. An apparatus as claimed in claim 14, wherein said processing device is operable to assign said symbols in the corresponding said TDM frame to respective carriers of said TDM-MCM symbols in said TDM-MCM symbol frame.

16. A apparatus as claimed in claim 15, wherein said apparatus is employed at a terrestrial re-radiation station that is operable to receive said TDM data stream and transform to said symbols therein into respective subcarriers to generate TDM-MCM frames comprising TDM-MCM symbols, said processing device being operable to assign said symbols in

respective said TDM frames in said TDM data stream to said subcarriers of said TDM-MCM symbols in corresponding said TDM-MCM frames.

17. A system for use at a terrestrial re-radiation station comprising:

a receiver for receiving a time division multiplexed or TDM data stream from a satellite;

a transcoder connected to said receiver for transforming said TDM data stream into a multicarrier modulated (MCM) waveform to create a time division multiplexed/multicarrier modulated or TDM-MCM signal that is robust to terrestrial path transmission multipath and blockage vagaries and interferences; and

a transmitter connected to said transcoder for transmitting said TDM-MCM signal.

18. A system as claimed in claim 17, wherein said transmitter is configured to re-radiate said TDM-MCM signal over terrestrial paths to distances between approximately 2 kilometers and 10 kilometers where reception from the satellite is blocked.

19. A system as claimed in claim 17, wherein said transmitter is configured to re-radiate said TDM-MCM signal over terrestrial paths in at least one of a city and along a roadway to selected distances where reception from the satellite is blocked by buildings and trees, respectively.

20. A system as claimed in claim 17, wherein a plurality of said systems are located at respective terrestrial re-radiation stations in a single frequency network, said systems operating substantially simultaneously using timing coordination and synchronization with respect to one another to achieve substantially seamless reception of said TDM-MCM signal over the area associated with said single frequency network.

21. A system as claimed in claim 20, wherein said terrestrial re-radiation stations are geographically located to serve a city and its surrounding suburban regions.

22. A method of transmitting a broadcast channel in a time diversity communication system wherein an early signal and a late signal are transmitted via at least one

satellite, the early signal comprising at least part of the broadcast channel and the late signal comprising another part of the broadcast channel, the late signal corresponding to the early signal but delayed a selected period of time with respect to the early signal, the communication system comprising a network of terrestrial re-radiation stations for receiving and processing the early signal to transmit a terrestrial re-radiation signal, the method comprising the steps of:

determining the respective differences in distance between said satellite and each of said terrestrial re-radiation stations in said network; and

correcting said terrestrial re-radiation signal to compensate for differences in times of arrival of said early signal at respective ones of said terrestrial re-radiation stations.

23. A method as claimed in claim 22, wherein said network is a single frequency network.

24. A method as claimed in claim 22, further comprising the steps of:

defining at least one approximate center of coverage among a selected number of said terrestrial re-radiation stations;

determining the respective differences in distance between each of said selected number of said terrestrial re-radiation stations and said approximate center of coverage; and

correcting said terrestrial re-radiation signal to compensate for different times of arrival of said terrestrial re-radiation signal transmitted from said selected number of said terrestrial re-radiation stations at a receiver due to differences in distance between respective ones of said selected number of said terrestrial re-radiation stations and said approximate center of coverage.

25. A method as claimed in claim 22, wherein said correcting step comprises the step of compensating for the delay in converting said satellite signal to said terrestrial re-radiation signal.

26. A method of transmitting a broadcast program in a time diversity communication system wherein an early signal and a late signal are transmitted via at least one satellite, the early signal comprising at least part of the broadcast program and the late signal corresponding to the early signal but delayed a selected period of time with respect to the early signal, the communication system comprising a network of terrestrial re-radiation

stations for receiving and processing the early signal to transmit a terrestrial re-radiation signal, the method comprising the steps of:

defining at least one approximate center of coverage among a selected number of said terrestrial re-radiation stations which are geographically separated;

determining the respective differences in distance between each of said selected number of said terrestrial re-radiation stations and said approximate center of coverage; and

correcting said terrestrial re-radiation signal to compensate for different times of arrival of said terrestrial re-radiation signal transmitted from said selected number of said terrestrial re-radiation stations at a receiver due to differences in distance between respective ones of said selected number of said terrestrial re-radiation stations and said approximate center of coverage.

27. A method as claimed in claim 26, wherein said correcting step comprises the step of compensating for the delay in converting said satellite signal to said terrestrial re-radiation signal.

28. A method of providing a broadcast program to receivers comprising the steps of:

receiving satellite signals which are transmitted using one of only time diversity or time and space diversity, said satellite signals comprising said broadcast program when maximum likelihood combined;

receiving a terrestrial re-radiation signal comprising said broadcast program and transmitted from a terrestrial re-radiation station;

determining which of said maximum likelihood combined satellite signal and said terrestrial re-radiation signal has the best signal quality;

selecting either of said maximum likelihood combined satellite signal or said terrestrial re-radiation signal having the best output signal quality; and

suppressing switching from said selected signal to the other one of said maximum likelihood combined satellite signal and said terrestrial re-radiation signal unless a selected condition is satisfied.

29. A method as claimed in claim 28, wherein said selected signal quality condition corresponds to a selected threshold for the bit error rate for reception of the terrestrial re-radiation signal.

30. A method as claimed in claim 29, wherein said selected threshold for bit error rate is greater when said terrestrial re-radiation signal is selected and said maximum likelihood combined satellite signal is suppressed than when said maximum likelihood combined satellite signal is selected and said terrestrial re-radiation signal is suppressed.

31. A method as claimed in claim 28, wherein said maximum likelihood combined satellite signal and said terrestrial re-radiation signal do not implement time diversity or time and space diversity.

32. A method as claimed in claim 28, wherein said receiving step for receiving said satellite s signals further comprises the step of delaying said satellite signals to compensate for delay incurred at said terrestrial re-radiation station by generating said terrestrial re-radiation signal from said satellite signal.

33. A method as claimed in claim 32, wherein said satellite signal is a time division multiplexed signal and is converted to said terrestrial re-radiation signal using time division multiplexing/multicarrier modulation.

34. A method as claimed in claim 33, wherein said delay incurred at said terrestrial re-radiation station corresponds to processing said satellite signal to convert said satellite signal from said time division multiplexed signal to a time division multiplexed/multicarrier modulated waveform at said terrestrial re-radiation station.

35. A method as claimed in claim 28, wherein said satellite signal is a time division multiplexed signal and is converted to a time division multiplexing/multicarrier modulated waveform at said terrestrial re-radiation signal using time division multiplexing/multicarrier modulation to generate said terrestrial re-radiation signal, and a mobile receiver receives and recovers both said time division multiplexed signal and said time division multiplexing/multicarrier modulated waveform.

36. A method as claimed in claim 28, wherein said satellite signals are transmitted via transmitted via a satellite using a first frequency, said terrestrial re-radiation signal being transmitted via a second frequency by at least one terrestrial re-radiation station, said receiving step for said satellite signals and said receiving step for said terrestrial re-radiation signal being

performed by a first radio frequency receiver section and a second radio frequency receiver section, respectively, on at least one of said receivers.

37. A method as claimed in claim 28, wherein said satellite signals are transmitted via transmitted via a first satellite using a first frequency, said satellite signals are transmitted via transmitted via a second satellite using a second frequency, said terrestrial re-radiation signal being transmitted via a third frequency by at least one terrestrial re-radiation station, said receiving step for said satellite signals being performed by a first receiver section and a second receiver section operating at said first frequency and said second frequency, respectively, and said receiving step for said terrestrial re-radiation signal being performed by a third receiver section operating at said third frequency on at least one of said receivers.

38. A method of providing a broadcast program to receivers comprising the steps of:

receiving a satellite signal comprising said broadcast program, said satellite signal being characterized as a single broadcast data stream comprising an early channel corresponding to said broadcast program, and a late channel having at least a portion of said broadcast program that is delayed by a selected period of time before transmission thereof, said early channel and said late channel each having a synchronization code, said broadcast data stream having been encoded by a parent convolutional coder operating at a selected code rate;

delaying said early channel by said selected period of time; and

combining said late channel with said early channel in a maximum likelihood Viterbi decoder operating at said code rate to recover said broadcast program signal free any of interrupts due to uncorrelated blockages in reception of said early channel and said late channel.

39. A method as claimed in claim 38, wherein said broadcast data stream comprises broadcast programs for mobile reception and broadcast programs for stationary reception, said early channel comprising only said broadcast programs for mobile reception.

40. A method as claimed in claim 38, further comprising the step of receiving a terrestrial re-radiation signal from a terrestrial re-radiation station, and a second satellite signal comprising said broadcast program and providing spatial diversity with respect to said satellite signal, said terrestrial re-radiation signal and said second satellite signal each comprising at

least a portion of said broadcast program and said synchronization code, and wherein said combining step comprises that steps of:

aligning said satellite signal, said second satellite signal and said terrestrial re-radiation signal using said synchronization code; and

combining to generate an output using at least one of said satellite signal, said second satellite signal and said terrestrial re-radiation signal.

41. A method as claimed in claim 40, wherein said early channel and said late channel are assigned only to, respectively, said satellite signal and said second satellite signal.

42. A method as claimed in claim 40, further comprising the step of receiving a second satellite signal comprising said broadcast program and providing spatial diversity with respect to said satellite signal, wherein said satellite signal and said second satellite signal are transmitted from different orbital positions in a geosynchronous orbit.

43. A method as claimed in claim 40, further comprising the step of receiving a second satellite signal comprising said broadcast program and providing spatial diversity with respect to said satellite signal, wherein said satellite signal and said second satellite signal are transmitted from three or four different elliptical orbits inclined by approximately 63° relative the earth's equator with a period of one sidereal day.

44. A method performing at a transmitter to prepare for maximum likelihood reception by a Viterbi convolution decoder at a receiver comprising the steps of:

using a parent convolution coder to code a broadcast program at a selected coding rate and generate parent output bits at a transmit station;

generating at said transmit station two higher rate convolution coded streams by puncturing said parent coded output bits to obtain a first set of punctured coded bits and a second set of punctured coded bits;

assigning said first set of punctured coded bits to an undelayed early channel;

assigning said second set of punctured coded bits to a late channel;

delaying said late channel a selected period of time with respect to said early channel; and

transmitting said early channel and said late channel, said selected period of time allowing said late signal to be uncorrelated with respect to said early signal at a mobile receiver

when services blockages occur due to physical obstructions between said mobile receiver and said transmitter impairing reception at said mobile receiver.

45. A method as claimed in claim 44, wherein said coding rate is R = 1/3.

46. A method as claimed in claim 45, wherein said higher rate convolution coded streams are generated at a rate R=3/4.

47. A method as claimed in claim 46, wherein said generating step comprises the steps of using 8 of every 18 bits for said first broadcast channel's coded bits, and another 8 of said 18 bits for said complimentary set to constitute a second broadcast channel's coded bits.

48. A method as claimed in claim 44, wherein said early channel and said late channel are combined at a receiver to reproduce said broadcast program free of interrupts from uncorrelated said service blockages.

49. A method as claimed in claim 48, wherein said early channel and said late channels each comprise at least one synchronization code, and further comprising the steps of:

delaying the received said early channel by said selected period of time;

correlating said synchronization code in each of the received said early channel and said late channel;

refining the alignment of the delayed said early channel with respect to the received said late channel to within a fraction of the width of one of a symbol and a bit in said broadcast program by causing the correlation spikes resulting from said correlating step to coincide; and

maximum likelihood combining bits in the received said early channel with said late channel in a soft decision Viterbi decoder to generate an output signal without uncorrelated service outages due to said physical obstructions.

50. A method as claimed in claim 49, wherein said soft decision Viterbi decoder operates at said selected coding rate of said parent convolution coder.

51. A method as claimed in claim 49, wherein said selected coding rate is R=1/3.